Protocols for Measuring Continuous Water Temperature Using an Onset Data Logger

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Standard Operating Procedure
Protocols for Measuring Continuous Water Temperature
Using an Onset Data Logger

1. Applicability. This standard operating procedure (SOP) applies to the collection and analysis of continuous water temperature data from wadeable rivers and streams in Maine using a HOBO Water Temp Pro logger from Onset Computer Corporation.

2. Purpose. The purpose of this SOP is to provide standardized methods for collecting and processing continuous water temperature data from wadeable rivers and streams in Maine.

3. Definition. Continuous water temperature data are those that are collected at certain time intervals (e.g., every 10 or 30 minutes) for an extended period of time (e.g., 4-6 weeks) using an electronic temperature logger deployed in a river or stream.

4. Responsibilities

A. Training. It is the responsibility of the task manager for whose project temperature data are collected to ensure that the individual(s) using the loggers are familiar with this SOP.

B. Tracking of temperature logger usage. It is the responsibility of the individual launching, deploying, or retrieving a logger to note these activities on the relevant tracking forms and/or field sheet; this is especially important if a logger is to be deployed and retrieved by different groups (i.e., algae *versus* macroinvertebrate staff). It is the responsibility of the task manager to place completed tracking forms and/or field sheet in the appropriate folder located in the Biomonitoring staff area.

C. Data retrieval and processing. It is the responsibility of the task manager or the staff member retrieving/processing the data to note these activities on the relevant tracking forms. When all data have been processed, these forms will be printed out and included in the Biomonitoring unit's QAPP folder.

5. Guidelines and Procedures

A. Measurement period. In the majority of cases, temperature data will be collected concurrently with the sampling of algae and/or macroinvertebrates during the summer low flow period.

B. Materials
   (1) Launched temperature logger, labeled with deployment location.
   (2) Cable ties, nylon (not cotton) rope, steel cable, and rebar where appropriate, to anchor logger in deployment location.
   (3) Lengths of PVC pipe (~6 inches) to shade and protect logger. PVC pipe has 2 holes drilled at one end to allow it to be secured to the logger with cable ties.
   (4) Appropriate field sheet to note deployment/retrieval of logger.
   (5) Color-coded flagging tape to mark logger location.

C. Precautions and limitations. The HOBO Water Temp Pro is only suitable for measurements in the range of 32°F to 122°F (0°C to 50°C).

D. Procedures
   (1) Pre-deployment logger precision test. Prior to each sampling season, all temperature loggers must be tested for precision according to the procedures outlined in the Protocols for Testing Temperature Logger Precision (App. A).
   (2) Pre-deployment logger launch
      (a) Connect IR Base station to a host computer that has the BoxCar software installed using the appropriate interface cable and align communication window on base station with communication window on logger.
      (b) Open BoxCar software program and go to Logger > HOBO Water Temp Pro > Launch. Update the description (i.e., planned deployment location) and measurements units (degrees Celsius). Make sure stealth mode is NOT selected. Select 'Launch Immediately' and logger should begin recording data, LED will blink every 5 seconds during logging.
      (c) Enter logger type and number and launch info (start date and time, name of MDEP staff who launched logger, measurement interval, planned deployment location) in the logger tracking file [H:L&W/WATERSHED/Monitoring & Assessment/Program/ Biomonitoring/SOP-QAPP/ Tracking temp loggers] (App. B). Using tape, label temperature logger with planned deployment location, i.e. waterbody name, town, station number or 'new (station)', descriptor such as 'above' or 'below' if necessary.
   (3) Logger deployment
      (a) Determine a suitable site for deployment in line with the program's objectives. In general, the logger should be deployed near the sample location in an area that is likely to stay inundated throughout the sampling period.

(b) Attach logger (with the sensor end down) with a cable tie, nylon (not cotton) rope, or steel cable to a suitable deployment point, for example:
  i. a sturdy structure such as a large tree root;
  ii. a rebar stake driven into the stream bed;
  iii. one of the sampling devices (e.g., rock bag). This is the preferred method if the site is being sampled for macroinvertebrates.
  If options (i) – (iii) are not applicable, the task manager should use his/her best judgment to find a suitable attachment point.

(c) If the deployment location is in a sunny area, the logger should be secured within a length of PVC pipe or shaded in some other way.

(d) The Hobo Water Temp Pro loggers tend to float and steps must be taken to ensure the logger remains completely submerged throughout the sampling period. For example, the logger could be placed under a boulder or within a length of PVC pipe with both ends secured so one end doesn't float.

(e) To aid in logger retrieval, make a drawing on the field sheet indicating logger location and note location (e.g., attached to rock bag). If deemed necessary, the area of deployment can also be flagged or marked with color-coded flagging tape, or the GPS coordinates of the location, if available, can be recorded.

(f) Check box 'Temperature Probe deployed' on the field sheet and note logger number. Make sure to note if the logger was deployed in a different location than planned. Back at the MDEP office, enter deployment information in the temperature logger tracking file (App. B).

(4) Logger retrieval

(a) Locate the logger utilizing drawing, notes, flagging, marking, or GPS coordinates as available/necessary. Retrieve logger and check box 'Temperature Probe retrieved' on the field sheet. Back at the MDEP office, enter retrieval information in the logger tracking file (App. B).

(b) Keep logger in a safe location and return it to the MDEP office for data retrieval and processing.

(5) Data retrieval

(a) Connect IR Base station to a host computer that has the BoxCar software installed using the appropriate interface cable.

(b) Open BoxCar software program and go to Logger > HOBO Water Temp Pro > Readout.

(c) Once logger has appeared in window, select 'Stop Search' and 'Readout'. Next, click 'Stop Logging and Off-load Data'.

(d) Select location to save data [H:L&W/WATERSHED/Monitoring & Assessment/Program/Biomonitoring/STREAM DATA/H2OTEMPS/ (appropriate year)/dtf files/] and rename file as appropriate [e.g., 'Pretty_Brook_S###_PrettyTown.dtf'; if station (S) number has not yet been assigned, say 'Snew' and add descriptor, e.g., 'upstream' or 'below_POTW' if necessary]. In window 'Data off-load successful', click OK, then click OK for Series 'Temperature (C)' and 'Select time offset

from UTC (GMT) = -4'. This will create a graph of all data records collected.

(e) Enter retrieval information in temperature logger tracking file (App. B).

(6) Data processing

(a) Export data into a text file:

i. With desired BoxCar Pro graph (.dtf file type) open, go to File > Export > Custom > Preferences. Set the Date Style to 'Month and Day (Incl. Year)', the Date/Time Separator to 'Space ()', the Time Style to 'Hr. Min.' and the Data Separator to 'Comma (,)', click OK.

ii. Click on Export and select location to save text file [H:L&W/ WATERSHED/ Monitoring & Assessment/Program/ Biomonitoring/STREAM DATA/ H2OTEMPS/(appropriate year)/text files/] and rename as appropriate [see (5) (d), above, but use file extension 'txt').

iii. Enter processing information in temperature logger tracking file (App. B).

(b) Convert text file to an Excel file:

i. In Excel, open desired text file from location noted in (6) (a) (ii), above.

ii. Select 'Delimited' data file type and click Next. Select 'Tab' and 'Comma' as Delimiters. Click Finish.

iii. Save file as a Microsoft Excel Workbook in desired location [H:L&W/WATERSHED/Monitoring & Assessment/Program/ Biomonitoring/STREAM DATA/ H2OTEMPS/ (appropriate year)/Excel files/] and rename as appropriate [see (5) (d), above, but use file extension 'xls').

iv. Enter processing information in temperature logger tracking file (App. B).

(c) For use of temperature data in the biomonitoring portion of the annual SWAT report please see Protocols for creating Temperature graphs and transferring them into a Word file for the SWAT report (App. C).

6. Care and Maintenance

A. After use, clean the loggers using non-abrasive, mild, antibacterial soap and warm water with a non-scratching sponge or cloth. Any scratches on a logger's communication window may impair downloading of data. If necessary a plastic polish may be used for tougher cleaning jobs.

B. Be sure to keep the logger free from dirt and dust when not in use.

7. QA/QC Procedures. At the start of each sampling season, all temperature loggers must be tested for precision using the procedure outlined in the Protocols for Testing Temperature Logger Precision (App. A).

8. References

BoxCar Pro User's Manual, Onset Computer Corporation, Bourne, MA
HOBO Water Temp Pro User's Manual, Onset Computer Corporation, Bourne, MA